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Abstract

By constructing the global input-output (GIO) table for fourteen years from 1997 through 2010 with 35 industries, 27 endogenous countries and 61 exogenous countries, this paper developes the new indices to measure the degree of shock transmission in terms of intermediate inputs and value-added contents. It is shown that Japan's finished goods exports tend to be affected substantially by the negative world demand shock, but the shock effect tends to be absorbed in Japanese domestic sectors and is not transmitted from Japan to other Asian countries. In contrast, Asian countries depend largely on Japan for their procurements of intermediate input goods. While China plays a larger role of regional manufacturing hub than Japan in terms of intermediate inputs, China's value-added exports are smaller than Japanese value-added exports. The asymmetric pattern of shock transmission between Japan and other Asian countries explains why Japan was much more affected by the global financial crisis in 2008-09 than other regional countries.

JEL Classification: F15, F33, F42, F44
Keywords: Global Input-Output table, shock transmission, Asia, production-chain, intermediate goods trade, value-added trade

1. Introduction

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In September 2008, the world plunged into the unprecedented global financial crisis (GFC), accompanied by a deep decline in world trade. The United States experienced the most severe downturn in trade in terms of the magnitude and speed since the late 1960s (Crowley and Luo, 2011). This unprecedented collapse of world trade in 2008-09 is referred to as the "Great Trade Collapse". According to Table 1, US imports from the selected Asian and European countries fell rapidly from the 4th quarter of 2008 through the end of 2009. US imports from Japan and Malaysia became a negative growth in the 3rd quarter of 2008, and Japan appears to have been the most severely affected by the US import decline. Table 2 shows the amount of changes in US imports of finished goods from 2008 to 2009 by industry and by source country. The magnitude of decline in US imports of motor vehicles from Japan is by far the largest. In the electric machinery industry,[4] a fall in US imports from Malaysia and Japan is far larger than that from other countries. In contrast, a decline in US imports from China is surprisingly small compared to the corresponding decline from other countries, even though China plays a central role of regional processing trade in Asia, especially in the electric machinery industry (Koopman *et al*., 2008, 2012, and Athukorala, 2009).

[Insert Table 1 around here.]
[Insert Table 2 around here.]

A direct impact of the global (US) shock on Asian exports has often been analyzed in the literature. Recent studies such as Ando and Kimura (2012) analyze the impact of the global financial crisis on Japanese and Asian exports at the most disaggregated level, and decompose export changes into extensive and intensive margins to examine which factor most affected Japanese and Asian exports. Given growing regional production network in Asia,[5] however, it is more important to investigate how the effect of global shock is transmitted among regional economies through induced changes in domestic production and trade of intermediate goods. Such regional shock transmission can magnify the effect of negative world demand shock, driving regional economies into serious economic downturn. To get a clue to evaluate the progress of regional economic linkages and value chains, this paper investigates whether and how a

[4] In Table 2, the sum of Y14, Y15 and Y16 corresponds to the electric machinery industry. As will be discussed below, we constructed a globally-linked input-output table with 35 industry classifications. Table 2 is based on our industry classification.
[5] Ferrarini (2013) maps global and regional linkages in production network and vertical trade, and shows a rapid increase in the degree of regional linkage in East Asia.

sharp fall in finished goods exports of Asian countries to the world reduced domestic production and then induced subsequent decline in intra-Asian trade along the production chain during the GFC.

One useful approach is to utilize the internationally-linked input-output (IO) table, where bilateral trade linkages are decomposed into two types of trade, i.e., transactions of intermediate inputs and final goods,[6] at a detailed industry level. While this approach provides us with rich information to investigate economic linkages and value chains, it was generally hard to obtain the updated time series data on the internationally-linked IO table.[7]

In recent years, however, there have been numerous attempts to overcome the limitted availability of the internationally-linked IO table.[8] One of the most notable developments is the World Input-Output Database (WIOD) that started to be published in April 2012, where the annual data on the internationally-linked IO table with 40 endogenous countries are available from 1995 to 2011.[9] The advantage of WIOD is to cover not only 27 European countries but also other major countres such as the United States, Canada and Russia as an endogenous country. However, the WIOD covers just six endogenous economies from Asia, which is not sufficient to analyze Asian value chains.[10] By including more Asian countries, we also construct a new dataset on the internationally-linkeded IO table, which is called the YNU-GIO (Global Input-Output) table,[11] with 27 endogenous countries for every year from 1997 through 2010. While both WIOD and YNU-GIO cover not only Asian but also European countries, the YNU-GIO includes more Asian countries as endogenous and exogenous countries,[12] with a focus on dynamic structural changes and integration in Asian region.[13]

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[6] Final goods include both finished goods and capital goods.

[7] A widely used internationally-linked IO table in Japan is the Asian International IO (Asian IIO) table published by Institute of Developing Economies. However, the Asian IIO table is published every five years and the latest IIO table becomes available usually after more than five-year delay. From the end of March 2014, the year 2005 Asian IIO table was published after a 9-year delay. See the website of IDE-JETRO (http://www.ide.go.jp/English/Publish/Books/Sds/material.html).

[8] See, for example, Hummels, Ishii and Yi (2001), Daudin, Rifflart and Schweisguth (2011) and Johnson and Noguera (2012).

[9] See the website of the WIOD for details (http://www.wiod.org/index.htm). For research based on the WIOD data, see, for instance, Foster and Stehrer (2013) and Timmer, Erumban, Los, Stehrer and de Vries (2014).

[10] As an endogenous country, six Asian economies (Japan, China, Korea, Taiwan, Indonesia and India) are included, but.most ASEAN countries are not covered in the WIOD.

[11] The YNU-GIO table is constructed as a part of the research project of the Center for Economic and Social Studies in Asia (CESSA), Department of Economics at Yokohama National University (YNU).

[12] Nine Asian economies are included as an endogenous country in the YNU-GIO: Japan, China, Korea, Taiwan, Malasia, Indonesia, Thailand, Vietnam and India. In addition, the YNU-GIO covers thirty-three Asian economies including Hong Kong, Singapore and the Philippines as an exogenous country.

[13] Given growing Asian trade with European countries as well as North American countries, it is necessary to include these countries in an internationally-linked I-O table as an endogenous country. The

Utilizing the YNU-GIO table, we develop a new index to measure the extent of shock transmission, whereby both direct and indirect impacts of the shock can be evaluated in multiple stages of production process. To calculate the index, we conduct a simulation analysis by generating industry-specific shocks to the world import demand, which enables us to explore how and to what extent the effect of a decline in the world import demand for final goods is transmitted directly and indirectly to production and trade of intermediate goods especially among Japan and Asian countries.

To anticipate the results, we show that there is an asymmetric pattern of shock transmission between Japan and other Asian countries. Japan is affected substantially by the global shock in the transport equipment and electric machinery industries, but the shock is not transmitted regionally from Japan to other Asian countries in terms of both intermediate inputs and value-added contents. The global shock tends to be absorbed in the Japanese domestic sectors. As a manufacturing hub, China plays a major role in supplying intermediate inputs regionally and globally, especially in the electric machinery industry, which enhances the degree of regional economic integration in Asia and also inter-regional linkages between Asia, North America and Europe. However, China's value-added exports are smaller than Japanese value-added exports, implying that Japan is more vulnerable to regional and world demand shocks than China and other countries.

The remainder of this paper is organized as follows. Section 2 presents the methodology of this paper by presenting the new indices of shock transmission. Section 3 describes the data construction of the YNU-GIO table, and Section 4 presents the results of the shock transmission analysis. Finally, Section 5 concludes.

2. Methodology: Shock Transmission Indices

2.1 Graphic Illustration

To evaluate the degree of global and regional economic linkages and value chains, we develop a new index of shock transmission. For a brief exposition of the new index, let us assume a four endogenous country model that consists of the United States, Japan, China and Korea (Figure 1). Suppose that the US import demand for finished goods from China declined by US$17 billion, which is equivalent to a 10% decline in the

YNU-GIO table includes 27 endogenous countries, which is a great advantage over the Asian IIO table published by the IDE-JETRO, because the Asian IIO table includes just 10 countries (i.e., 9 Asian countries and the United States) as an endogenous country.

actual amount of China's exports of finished goods to the United States in 2005 and regarded as a negative demand shock. As illustrated in Figure 1a, China's domestic production declines by US$15.9 billion, where intermediate input contents are US$10.3 billion and value-added contents are US$5.6 billiion.[14] The negative US import demand shock also induces a fall in China's imports of intermediate inputs from other three countries: 644 million from Japan, 320 million from Korea and 178 million from the United States.

[Insert Figure 1 around here.]

As an illustration of the first-stage indirect effect, let us next look at what happens to Japanese production induced by the above direct impact. In Figure 1b, a fall in China's imports of intermediate inputs from Japan (US$644 million) causes a decline in Japanese production, which induces a reduction in procurement of intermediate inputs (US$613 million) from domestic sectors, where intermediate input contents are US$375 million and value-added contents are US$238 million. The decline in Japanese production also induces a fall of Japanese imports from other three countries: US$3 million from Korea, US$7 million from the United States, and US$21 million from China. This first-stage indirect effect occurs in other endogenous countries as well, that is, in Korea and the United States.

[Insert Figure 2 around here.]

Due to the first-stage indirect effect, domestic production declines further, accompanied by a second-round reduction of not only domestic procurements but also imports of intermediate inputs from other endogenous countries. This indirect effects continue to the *N*-th stage where the effect becomes negligible. Finally, the magnitude of shock transmission is computed as the sum of direct and cumulative indirect effects on endogenous economies, as shown in Figure 2a. By standardizing the sum of direct and cumulative indirect effects by the direct impact on Chinese exports, we calculate the "shock transmission index (*STI*)". Figure 2b shows the result of the *STI* in four engdogenous countries. The *STI* tends to be the largest in China, a country that first experiences the export reduction of finished goods. In Figure 2b, Japan takes the largest *STI* of both intermediate contents and value-added contents (7.4 and 6.2, respectively)

[14] The amounts of intermediate input contents and value-added contents presented in this section are obtained from the YNU-GIO table.

among the endogenous countries except China, which shows not only that Japan is the largest supplier of intermediate inputs to China, but also that Japan tends to be most affected by the shock to Chinese exports.

We have so far assumed that only one country, China, is hit by the export shock. But, it is usual that other countries are also affected by the global shock simultaneously. To assess the actual pattern and impact of shock transmission, we develop a multi-country version of the *STI*, so-called the simultaneous shock transmission index (*SSTI*), where all endogenous countries experience a decline of finished goods exports to a particular country such as the United States. We can also calculate *SSTI*s by assuming a decline of Chinese exports to other single country, a region such as the North America and Europe, or the world. Mathematical exposition of the *STI* under the three-country GIO model is presented in Appendix 1. The rest of this section shows how to derive the *SSTI* based on the three-country GIO model.

2.2 Three-Country GIO Model

To evaluate the degree of shock transmission when all endogenous countries encounter a fall of finished goods exports to the world, we develop the *SSTI*, where finished goods exports of country 1, 2 and 3 decline by ΔX^1, ΔX^2 and ΔX^3, respectively. This simultaneous decline in finished goods exports induces a fall in production in three countries and can be estimated by using the Leontief inverse matrix *L* as:

$$L\Delta\hat{X} = \begin{bmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{bmatrix} \begin{bmatrix} \Delta X^1 & 0 & 0 \\ 0 & \Delta X^2 & 0 \\ 0 & 0 & \Delta X^3 \end{bmatrix} = \begin{bmatrix} L^{11}\Delta X^1 & L^{12}\Delta X^2 & L^{13}\Delta X^3 \\ L^{21}\Delta X^1 & L^{22}\Delta X^2 & L^{23}\Delta X^3 \\ L^{31}\Delta X^1 & L^{32}\Delta X^2 & L^{33}\Delta X^3 \end{bmatrix}$$

The right hand side of the above equation estimates the amount of decrease in the domestic gross production induced by the export decline in all three countries, which measures the degree of shock transmission among three countries. Since gross production consists of intermediate inputs and value-added, we can analyze the effect of export shock through intermediate input channel and valule-added channel denoted by *SST*(*Int*) and *SST*(*VA*), respectively:

$$SST(Int) = A\left(L\Delta\hat{X}\right) \text{ and } SST(VA) = \hat{A}v\left(L\Delta\hat{X}\right),$$

where A is the intermediate input coefficient matrix; $\hat{A}v$ is the diagonal matrix of value-added coefficient; L is the Leontief inverse matrix; $\Delta\hat{X}$ is a diagonal matrix of the country i's import demand for finished goods ΔX^i.

We define the corresponding shock transmission indices (*SSTI*s) by standardizing *SST*s vertically with the total of export shocks in respective countries. In mathematical notation, *SSTI*s are defined as

$$SSTI(Int) = A\left(L\Delta\hat{X}\right)\begin{pmatrix} \frac{1}{\Sigma\Delta X^1} & 0 & 0 \\ 0 & \frac{1}{\Sigma\Delta X^2} & 0 \\ 0 & 0 & \frac{1}{\Sigma\Delta X^3} \end{pmatrix} \text{ and}$$

$$SSTI(VA) = \hat{A}v\left(L\Delta\hat{X}\right)\begin{pmatrix} \frac{1}{\Sigma\Delta X^1} & 0 & 0 \\ 0 & \frac{1}{\Sigma\Delta X^2} & 0 \\ 0 & 0 & \frac{1}{\Sigma\Delta X^3} \end{pmatrix},$$

where $\Sigma\Delta X^i$ is the sum of contry i's export decline of finished goods.

*SSTI*s for intermediate inputs and value-added contents among 27 endogenous countries are presented and discussed in details in Section 4.

3. Data: YNU-GIO Table

We have constructed a new dataset of the internationally-linked IO table, that is, the YNU-GIO table, for fourteen years spanning from 1997 through 2010 with two benchmark years: 2000 and 2005. Specifically, the YNU-GIO table includes twenty-seven endogenous countries and sixty-one exogenous countries (including the rest of the world: ROW) with thirty-five industrial classifications.[15] The benchmark YNU-GIO table is estimated from the OECD IO tables with 48 industrial categories and from the trade data at the 4- and 5- digit SITC3 level obtained from the UN Comtrade database.

While a single-country IO table does not provide us with any information on source countries for imported intermediate and finished goods, the internationally-linked IO table links single-country IO tables between endogenous countries using the international trade data by source/destination country and by industry. We conform the import blocks of the OECD IO table (both for imported intermediate and final goods) to

[15] See Appendices 2 and 3 for the list of the endogenous and exogenous countries and for that of the production industries in the YNU-GIO table.

the YNU-GIO classification. Consequently, the YNU-GIO table has thirty-five production industries, twenty-seven endogenous countries and sixty-one exogenous countries.

The YNU-GIO table is constructed by the following procedure. First, we collect the source country breakdown data on imports of each endogenous country at the 4- or 5-digit SITC3 level (3,121 categories). These data are classified into three types of goods, namely intermediate, consumption and capital goods, by matching the SITC3 code with the BEC (Broad Economic Categories) code. We also conform the SITC3 categories to the ISIC3 ones to convert the trade classification into the industry classification.[16] Among 3,121 SITC3 categories, 1,933 categories correspond to intermediate goods, while the remaining 1,188 categories are regarded as the final demand in the IO and GIO framework.[17] In addition, each of the intermediate and final demand transactions is converted into the ISIC classification at the 4-digit level, which amounts to 145 categories. By aggregating the 4-digit level of ISIC3, we obtain the 2-digit level of ISIC3 (62 classifications), which is in turn converted into the OECD IO classification (48 categories[18]) and then into the 35 YNU-GIO industries. Finally, by using the import data by source country and by industry, we obtain the import share of each endogenous country for both intermediate and final goods. Thus, we can overcome a drawback of the conventional approach, such as Hummels, Ishii and Yi (2001) and Ng (2010), which uses the bilateral trade data without distinguishing intermediate goods trade from final goods trade. For the details of how to estimate the benchmark and non-benchmark YNU-GIO table, see Appendix 4.

4. Results of Global and Regional Shock Transmission

In this section, we compute *SSTI*s with an assumption that all endogenous countries are affected by the global shock, that is, by an actual decline in finished goods exports of all endogenous countries to the world.[19] We focus not only on the all

[16] UN web pages http://unstats.un.org/unsd/cr/registry/regsale.asp?Lg=1 and http://unstats.un.org/unsd/cr/registry/regdnld.asp?Lg=1 provide links for code conversion from SITC3 to ISIC3 and from SITC3 to BEC respectively.

[17] Final demand (1,188 categories) is decomposed into consumption goods (713 categories) and capital goods (475 categories).

[18] See http://www.oecd.org/dataoecd/32/56/47059256.pdf for the conversion rule from the ISIC3 to OECD IO classification.

[19] The actual amount of decline in finished goods exports of each endogenous country to the world from 2008 to 2009 is presented in Table 4 below. *SSTI*s allow for the economic size effect by using the actual amounts of decline in exports of final goods. While *SSTI*s capture the accumulated shock effects as a

manufacturing industries but also on two major industries: the electric machinery and transport equipment industries.

4.1 The Effect of GFC and Shock Transmission in All Manufacturing Industries

SSTI for Intermediate Input Procurements

Table 3 shows *SSTI*s for intermediate goods in all manufacturing industries. A column of figures shows *SSTI*s of an endogenous country listed horizontally on the top of Table 3. We read each column vertically to assess the extent of shock transmission. For instance, the second left column exhibits China's *SSTI*s with endogenous and exogenous countries. China's *SSTI* with its own, China, is 154.0, which means that an induced reduction in domestic production is equivalent to 154.0 percent of the actual amount of decline in China's finished goods exports to the world. China's *SSTI* with Japan is the second largest (15.3), and *SSTI* with Korea is the third largest (10.0), which shows the China's large dependence on the two countries in procuring intermediate input goods, as illustrated in Figure 2b.

[Insert Table 3 around here.]

We can observe several interesting patterns of *SSTI*s among endogenous countries. First, in the Asian region, Japan and China are the most important suppliers of intermediate input goods. Looking at a column of figures for Taiwan, for instance, Taiwan's *SSTI* is very high with Japan (28.4) and China (25.6), which indicates a large dependence on Japan and China in Taiwan's procurement of intermediate input goods. Figures on the diagonal part in Table 3 show the extent of shock influences on domestic production. In Malaysia, *SSTI* for domestic production is 52.8, which is almost equivalent to the sum of *SSTI*s with Japan (23.3) and China (29.4). Thailand also exhibits high *SSTI*s with Japan (21.9) and China (16.7), while its *SSTI* for domestic production is 48.9. Korea also indicates high *SSTI* with Japan (19.6) and China (22.5). Vietnam shows high *SSTI*s not only with China (29.8) but also with Korea (12.8) and Taiwan (12.0), while its *SSTI* with Japan is somewhat lower (8.8). Thus, these Asian countries, except for Indonesia and India, are closely integrated into Japan and China along the production chain, with large procurement of intermediate input goods from Japan and China.

result of complicated direct and indirect interactions among the countries, *STI*s can show a clearer pattern of shock transmission through a single country. However, *STI*s do not allow for the economic size of endogenous countries.

Second, Japan plays a unique role in the regional production network in Asia. On one hand, Japan is an important supplier of intermediate input goods to other Asian countries, on the other hand, Japan's dependence on regional countries in procuring intermediate inputs is particularly small. Japan's *SSTI*s, a far left column of Table 3, exhibit a very small number with almost all countries except China (7.3). In contrast, China's *SSTI*s with other countries are on average higher than Japan's *SSTI*s. Even though Japan has built a regional production network in Asia, Japan shows little tendency to import intermediate input goods not only from regional countries but also from other countries outside the region, likely because Japan has a large number of intermediate suppliers inside its country. This evidence also implies that when Japan is hit by the world demand shock, the shock is not transmitted to regional countries through Japan, but tends to be absorbed in the Japanese domestic production sector. Moreover, if regional countries are hit by the negative world demand shock, Japanese domestic production sector is likely to encounter a large decline in its exports of intermediate input goods to the regional economies. Such an asymmetric transmission pattern between Japan and other Asian countries is particularly important to evaluate the degree of regional interdependence in Asia.

Third, even for endogenous countries outside the region, Japan and China are important supplier of intermediate input goods. As shown in the first two rows of Table 3, all endogenous countries outside the Asian region show relatively high *SSTI*s with Japan and China ranging from 1.0 to 9.9. Among others, Mexico, Finland and Ireland exhibit high *SSTI* with China ranging from 12.0 to 19.3, indicating growing influence of China on other regions. Thus, the China's role of an intermediate input supplier becomes more important than Japan for countries outside Asia.

Fourth, the Untied States and Gernamy, respectively, play an important role in supplying intermediate input goods in North America and Europe. In North America, Canada and, to a lesser extent, Mexico depend heavily on the United States in procurement of intermediate input goods. In Europe, most countries are heavily dependent on Germany in procuring intermediate inputs for their production. In contrast to Japan, Germany exhibits high *SSTI*s with a number of regional countries, the rest of European countries (ROE), the United States and China. The United States shows high *SSTI*s not only with Canada and Mexico but also with several countries in Asia and Europe, especially China, Japan and Germany. Thus, even compared to the United States and Germany, Japan's dependence on other countries is particularly small in procuring intermediate input goods.

SSTI for Value-Added

We have so far looked at *SSTI*s for intermediate inputs and observed a growing role of China in supplying intermediate input goods not only to Asia but also to other regions. *SSTI*s for value-added in Table 4, however, suggest that the role of Japan becomes more important especially in the Asian region. First, Korea, Taiwan, Malaysia and Indonesia exhibit higher *SSTI*s for value-added with Japan than with China, showing that finished goods exports of these economies embody more of Japanese value-added than Chinese one. Even endogenous countries outside the Asian region tend to indicate high *SSTI*s for value-added with Japan and China. Japanese firms have actively expanded their overseas operations in North America and Europe, which promotes host countries to import intermediate inputs from Japan. In contrast, as shown in Koopman, Wang and Wei (2008, 2012), Chinese trade is largely driven by foreign subsidiaries, and processing exports account for a large share of Chinese exports, which tends to enhance the share of foreign value-added in Chinese manufacturing exports. Thus, even though China plays a role of regional manufacturing hub in Asia, trade thorough China tend to embody a smaller protion of Chinese value-added.

[Insert Table 4 around here.]

Second, *SSTI*s on the diagonal part in Table 4 show to what extent value-added contents come from its own domestic sectors. Japan's *SSTI* with its domestic sectors is the second highest (88.0) among the endogenous countries and much higher than the corresponding *SSTI* for China (70.3) and Korea (64.3).[20] Thus, if regional countries in Asia were hit by the negative demand shock or if their exports of finished goods to the world declined, Japan would be the most severly affected among the regional countries in terms of value-added.

Third, regional countries in North America and Europe, respectively, tend to indicate high *SSTI*s for value-added with the United States and Germany, while the US and Germany's dependence on other countries in terms of value-added content is quite low. However, Japan exhibits much lower dependence on value-added content of other countries than the United States and Germany. Japan's unique role and asymmetric pattern of shock transmission are also observed in terms of *SSTI* for value-added.

4.2 Shock Transmission in Electric Machinery and Transport Equipment

[20] In Indonesia, exports of mineral fuels still account for a half or more of its total exports, which likely makes Indonesia's *SSTI* for value-added the largest among the endogenous countries.

Tables 5-8 show *SSTI*s for intermediate inputs and value added in the case of electric machinery and transport equipment industries. Due to the space limitation, we present the results with a focus on two regions: one is Asia plus North America and the other is Europe. Inter-regional transmission is not reported in the tables, but available upon request.

Table 5 shows *SSTI*s for intermediate inputs in the electric machinery industry. First, *SSTI*s among the Asian countries are on average quite high and appear to be even higher than the degree of corresponding *SSTI*s among European countries. Second, most Asian countries exhibit very high *SSTI*s with China and Japan, ranging from 16.9 to 43.9, which means that electric machinery industries in Asia tend to procure large amount of intermediate inputs from China and Japan. The role of China and Japan as an intermediate input supplier is much larger than the corresponding role of Germany in Europe.[21] Third, although not reported in Table 5 due to the space limitation, China and, to a lesser extent, Japan play a large role in supplying European countreis with intermediate inputs. Seven European countries show high *SSTI*s with China, ranging from 10.4 to 30.6 in procurement of intermediate input goods in the electric machinery industry. While Germany supplies a large amount of intermediate input goods to Asian countries, the China's role as a supplier of intermediate input goods is much larger even for European countries.

[Insert Table 5 around here.]
[Insert Table 6 around here.]

When looking at *SSTI*s for value-added, however, Japan's influence is found to be more important in Asia. In Table 6, Korea, Taiwan and Malaysia exhibit higher *SSTI* with Japan than with China, which indicates that finished goods exports of the electric machinery industry in these countries embody more value-added contents from Japan than from China. In the European region, most countries indicate high *SSTI* with Germany, but the degree of dependence on Japan in Asia is larger than the corresponding dependence on Germany in Europe.

Turning to *SSTI*s in the transport equipment industry, Japan's influence as a supplier of both intermediate inputs and value-added contents becomes more evident. In

[21] Since electric machinery goods are produced by procuring intermediate inputs from various industries, computed *SSTI*s capture the shock transmission from the electric machinery industry to other industries as well.

Table 7, all Asian countries except Vietnam indicate much higher *SSTI* for intermediate input contents with Japan than with China. Thailand, a regional center of automobile industry in ASEAN, shows high *SSTI* with Japan (35.4) and *SSTI* with its own domestic sectors is relatively small (46.8) compared to other regional countries. In 2011, the automobile industry in Thailand suffered serious damage from massive floods. As Japanese automobile firms had advanced into Thailand to expand local production, Japanese firms also encountered the flood damage and could not avoid a sharp fall of intermediate goods exports from Japan to Thailand. Such production linkages are well reflected in Thailand's *SSTI* with Japan. In Europe, the role of Germany in supplying intermediate input goods to regional countries is very large, and the role of Japan is comparable to that of Germany for regional countries. Although not reported in Table 7, in the inter-regional transmission between Asia and Europe, Japan's role as a supplier of intermediate input goods is comparable to the role of Germany. However, for the North American countries, Japan is more important in their procurement of intermediate imputs than Germany, while China's influence is larger than Japanese one.[22]

[Insert Table 7 around here.]
[Insert Table 8 around here.]

In looking at *SSTI*s for value-added, the role of Japan and Germany is clearly large in Asia and Europe, respectively. According to Table 8, all Asian countries except India exhibit high *SSTI* for value-added with Japan ranging from 5.0 to 14.3, while all European countries except Ireland and Luxembourg show high *SSTI* for value-added with Germany ranging from 5.7 to 22.9. Another important point to note is that Japan's *SSTI* for value-added with other countries is particlularly low, which differes markedly from the United States and Germany. Moreover, Japan's *SSTI* for value-added with its own domestic sector is the largest (90.5) among endogenous countries except Luxemburg. Thus, if Japan and neibouring Asian countries were hit by the negative world demand shock, Japan would be affected most seriously.

4.3 Changes in Regional Value Chains

We have so far analyzed the effect of GFC on shock transmission focusing on

[22] This is not surprising, because US automobile firms advanced into China and actively operate their production and sales activities, which may facilitate North American imports from China. More importantly, North American automobile firms are likely to import large amounts of electronic devices and components for automobile from China, which is reflected in Table 7.

the Asian region. It is also worth investigating how regional and global value chains for intermediate inputs and value-added contens changed from 1997 to 2010. Figure 3 shows not only the share of regional procurements of intermediate inputs and value-added contents but also that of procurements from other regions. In the far left figure, Asian countries exhibit a remarkable growth in regional procurements of intermediate inputs from 21.3 percent in 1997 to 39.7 percent in 2010, which supports the recent findings that regional economic integration in Asia has been mainly driven by growing regional production network and fragmentation.[23]

[Insert Figure 3 around here.]

The second left figure in Figure 3 indicates that the level of regional procurements of intermediate inputs is still somewhat higher in Europe than in Asia, but it decilned slightly in Europe from the mid-2000s. Interestingly, North American countries increased their procurements of intermediate inputs from Asian countries, while the level of regional procurements declined to a large extent from early 2000s. Moreover, in the world procurements of intermediate inputs, the share of Asia increased substantially from 1997 and exceeded that of Europe in 2010.

Finally, although less evident than the case of intermediate input procurements, the share of value-added contents from Asia increased not only in Asian region but also in North America. Even in the world, the share of value-added contents from Asia increased steadily and surpassed that of value-added contents from Europe in 2010. The above observation suggests that Asia shows the significant progress of regional economic linkages and also becomes more integrated into global production network through intermediate input and value-added trade.

5. Concluding Remarks

Empirical research on global value chains has grown recently, especially after the WIOD was released. The YNU-GIO Table has an advangage over the WIOD in that more Asian countries are included as engdogenous and exogenous countries, which enables us to assess the extent of regional and global shock transmission along production chains especially in Asian region. We have shown that there is an asymmetric pattern of

[23] Kimura and Obashi (2011) make a good review on the recent research on regional production network in Asia.

shock transmission between Japan and other Asian countries. Japan is affected substantially by the global shock in the transport equipment and electric machinery industries, but the shock is not transmitted regionally from Japan to other Asian countries in terms of both intermediate inputs and value-added contents. The global shock tends to be absorbed in the Japanese domestic sectors. As a manufacturing hub, China plays a major role in supplying intermediate inputs regionally and globally, especially in the electric machinery industry. However, China's value-added exports are smaller than Japanese value-added exports. Even though China enhances regional economic integration through intermediate input transactions, Japan is more vulnerable to regional or global demand shock.

Our research can be extended in the following ways. First, more Asian countries need to be included as an endogenous country in our analysis. Although treated as an exogenous country in the current version of the YNU-GIO table, Singapore and the Philippines must be included as an endogenous country. Second, processing trade accounts for a large share in China's total trade, but it is not taken into account in this paper. Recently, Koopman *et al*. (2008, 2012) attempt to analyze the effect of processing trade on global value chains. This line of research is necessary to evaluate the role of China as a manufacturing hub more rigorously. Finally, our analysis covers fourteen years from 1997 to 2010, but Asian economic integration may have deepend further after then. Japan is likely to increase procurements of intermediate inputs from Asian countries after the rapid appreciation of the yen from 2009 to 2012.[24] Further efforts to update the YNU-GIO Table will be necessary.

[24] See, for instance, Shimizu and Sato (2014).

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Appendix 1. Shock Transmission Index under the Three-Country GIO Model

Let us assume a three-country model where each country produces in a single tradable sector. Each country produces a good that can be consumed as a final good or used as an intermediate input.[25] $Z = \begin{bmatrix} Z^{11} & Z^{12} & Z^{13} \\ Z^{21} & Z^{22} & Z^{23} \\ Z^{31} & Z^{32} & Z^{33} \end{bmatrix}$ is a matrix of intermediate goods transactions associated with production, $Y = \begin{bmatrix} Y^1 & Y^2 & Y^3 \end{bmatrix}'$, in the three-country internationally linked IO table (see Figure A1). Z^{ij} represents the amount of intermediate goods produced and supplied from country *i* to country *j* for production of output Y^j. $V = \begin{bmatrix} V^1 & V^2 & V^3 \end{bmatrix}$ is value added inputs necessary for the production of corresponding outputs, and $F = \begin{bmatrix} F^1 & F^2 & F^3 \end{bmatrix}'$ is the amount of finished goods produced in respective countries, where $F^i = F^{i1} + F^{i2} + F^{i3}$ for *i* = 1, 2, and 3.

Figure A1. Internationally-Linked Input-Output Table: Three-Country Model

		Intermediate goods procured/imported by:			Final goods procured/imported by:			Gross output
		Country1	Country2	Country3	Country1	Country2	Country3	
Goods sold/exported from	Country1	Z^{11}	Z^{12}	Z^{13}	F^{11}	F^{12}	F^{13}	Y^1
	Country2	Z^{21}	Z^{22}	Z^{23}	F^{21}	F^{22}	F^{23}	Y^2
	Country3	Z^{31}	Z^{32}	Z^{33}	F^{31}	F^{32}	F^{33}	Y^3
Value-added inputs		V^1	V^2	V^3				
Gross input		Y^1	Y^2	Y^3				

The global intermediate input coefficient matrix, A, and the global value added coefficient matrix, Av, can be, respectively, defined as:

$$A = \begin{bmatrix} A^{11} & A^{12} & A^{13} \\ A^{21} & A^{22} & A^{23} \\ A^{31} & A^{32} & A^{33} \end{bmatrix} = \begin{bmatrix} \frac{Z^{11}}{Y^1} & \frac{Z^{12}}{Y^2} & \frac{Z^{13}}{Y^3} \\ \frac{Z^{21}}{Y^1} & \frac{Z^{22}}{Y^2} & \frac{Z^{23}}{Y^3} \\ \frac{Z^{31}}{Y^1} & \frac{Z^{32}}{Y^2} & \frac{Z^{33}}{Y^3} \end{bmatrix} \text{ and } Av = \begin{bmatrix} Av^1 & Av^2 & Av^3 \end{bmatrix}' = \begin{bmatrix} \frac{V^1}{Y^1} & \frac{V^2}{Y^2} & \frac{V^3}{Y^3} \end{bmatrix}',$$

where $A^{ij} = \frac{Z^{ij}}{Y^j}$ denotes the amount of intermediate goods produced in country *i* that

[25] We assume that each country has only one production sector. This assumption can be easily extended to a multi-production sector model with the same matrix and vector notations.

contribute to a unit output produced in country *j*, and $Av^j = \frac{V^j}{Y^j}$ is the share of country *j*'s value added associated with a unit production in country *j*.

The global input-output balance equation can be derived as $Y = (I - A)^{-1} F = LF$, where $L = \begin{bmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{bmatrix}$ is the global Leontief inverse matrix.

Each element of the Leontief inverse matrix, L^{ij}, indicates the gross production induced in country *i* by the production of one unit of finished goods in country *j*. In other words, L^{ij} is a fraction of country *i*'s contents embodied in finished goods produced in country *j*.

Let us assume that the world demand for country 1's exports of finished goods declines by ΔX^1 amount, which reduces the country 1's procurement of intermediate inputs from domestic and foreign sectors. This also induces the next stage reduction of production and procurements in other endogenous countries, and this induced reduction continues to the infinite number of stages, which can be estimated by using the Leontief inverse matrix as:

$$\begin{bmatrix} L^{11} & L^{12} & L^{13} \\ L^{21} & L^{22} & L^{23} \\ L^{31} & L^{32} & L^{33} \end{bmatrix} \begin{bmatrix} \Delta X^1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} L^{11}\Delta X^1 \\ L^{21}\Delta X^1 \\ L^{31}\Delta X^1 \end{bmatrix},$$ where $L^{11}\Delta X^1$, $L^{21}\Delta X^1$ and $L^{31}\Delta X^1$ are embodied contents of country 1, 2 and 3, respectively. We can decompose gross contents of export shock ΔX^1 into embodied intermediate goods contents, *ST*(*Int*), and embodied value added contents, *ST*(*VA*):

$$ST(Int) = A \cdot \begin{bmatrix} L^{11}\Delta X^1 & 0 & 0 \\ 0 & L^{21}\Delta X^1 & 0 \\ 0 & 0 & L^{31}\Delta X^1 \end{bmatrix} = \begin{bmatrix} A^{11}L^{11}\Delta X^1 & A^{12}L^{21}\Delta X^1 & A^{13}L^{31}\Delta X^1 \\ A^{21}L^{11}\Delta X^1 & A^{22}L^{21}\Delta X^1 & A^{23}L^{31}\Delta X^1 \\ A^{31}L^{11}\Delta X^1 & A^{32}L^{21}\Delta X^1 & A^{33}L^{31}\Delta X^1 \end{bmatrix},$$

and

$$ST(VA) = \hat{A}v \cdot \begin{bmatrix} L^{11}\Delta X^1 & 0 & 0 \\ 0 & L^{21}\Delta X^1 & 0 \\ 0 & 0 & L^{31}\Delta X^1 \end{bmatrix} = \begin{bmatrix} Av^1L^{11}\Delta X^1 & 0 & 0 \\ 0 & Av^2L^{21}\Delta X^1 & 0 \\ 0 & 0 & Av^3L^{31}\Delta X^1 \end{bmatrix},$$

where $\hat{A}v$ is a diagonal matrix of vector Av.

We standardize each element of *ST*(*Int*) and *ST*(*VA*) by the sum of direct impact on country 1's exports (ΔX^1), which leads to the following shock transmission index (*STI*) for intermediate goods contents and value-added contents:[26]

$$STI(Int) = \begin{bmatrix} \frac{A^{11}L^{11}\Delta X^1}{\Delta X^1} & \frac{A^{12}L^{21}\Delta X^1}{\Delta X^1} & \frac{A^{13}L^{31}\Delta X^1}{\Delta X^1} \\ \frac{A^{21}L^{11}\Delta X^1}{\Delta X^1} & \frac{A^{22}L^{21}\Delta X^1}{\Delta X^1} & \frac{A^{23}L^{31}\Delta X^1}{\Delta X^1} \\ \frac{A^{31}L^{11}\Delta X^1}{\Delta X^1} & \frac{A^{32}L^{21}\Delta X^1}{\Delta X^1} & \frac{A^{33}L^{31}\Delta X^1}{\Delta X^1} \end{bmatrix} \text{ and } STI(VA) = \begin{bmatrix} \frac{Av^1L^{11}\Delta X^1}{\Delta X^1} & 0 & 0 \\ 0 & \frac{Av^2L^{21}\Delta X^1}{\Delta X^1} & 0 \\ 0 & 0 & \frac{Av^3L^{31}\Delta X^1}{\Delta X^1} \end{bmatrix}.$$

[26] We multiply *ST*(*Int*) and *ST*(*VA*) by a diagonal matrix each diaglnal element of which is an iverse of the finished goods export shock (ΔX^1) from the right-hand side.

APPENDIX 2: Endogenous and Exogenous Countries of the YNU-GIO Table

Endogenous country list:

Asia:

01	Japan (JPN)	04	Taiwan (TWN)	07	Indonesia (IDN)
02	China (CHN)	05	Malaysia (MAL)	08	Vietnam (VTM)
03	Korea (KOR)	06	Thailand (THL)	09	India (IND)

North America (N. America):

01	USA (USA)	02	Canada (CAN)	03	Mexico (MEX)

Europe:

01	France (FRA)	05	Belgium (BEL)	09	Luxembourg (LUX)
02	Germany (GER)	06	Finland (FIN)	10	Netherlands (NLD)
03	UK (UK)	07	Ireland (IRE)	11	Portugal (POR)
04	Austria (AUT)	08	Italy (ITA)	12	Spain (ESP)

Others:

01	Australia (AUS)	02	Brazil (BRA)	03	South Africa (SAF)

Exogenous country list:

Asia:

01	Hong Kong	03	the Philippines
02	Singapore	04	Rest of Asia

Europe:

01	Russia	02	Rest of European Union

Oil producing countries (OPEC):

01	Algeria	05	Iraq	09	Qatar
02	Angola	06	Kuwait	10	Saudi Arabia
03	Ecuador	07	Libya	11	UAE
04	Iran	08	Nigeria	12	Venezuela

Rest of the World (ROW)

APPENDIX 3: List of production industries of the YNU-GIO table

01	Agriculture, hunting, forestry and fishing
02	Mining and quarrying
03	Food products, beverages and tobacco
04	Textiles, textile products, leather and footwear
05	Wood and products of wood and cork
06	Pulp, paper, paper products, printing and publishing
07	Coke, refined petroleum products and nuclear fuel
08	Chemicals and pharmaceuticals
09	Rubber and plastics products
10	Other non-metallic mineral products
11	Basic metals
12	Fabricated metal products
13	Machinery and equipment
14	Office, accounting and computing machinery
15	Electrical machinery and apparatus
16	Radio, television and communication equipment
17	Medical, precision and optical instruments
18	Motor vehicles, trailers and semi-trailers
19	Other transport equipment
20	Other manufacturing
21	Electricity, Gas and Water supply
22	Construction
23	Wholesale and retail trade; repairs
24	Hotels and restaurants
25	Transport
26	Post and telecommunications
27	Finance and insurance
28	Real estate activities
29	Renting of machinery and equipment
30	Computer and related activities
31	Research and development
32	Other Business Activities
33	Public administration, social security and defense
34	Education
35	Health, social work and other services

Appendix 4: Estimation of the Benchmark and Non-Benchmark YNU-GIO Table

Let us denote the import share[1] of intermediate and final goods as $M(int)_i^{pq}$ and $M(f)_i^{pq}$, respectively, where upper suffixes p and q represent a source (either endogenous or exogenous) country and a destination (endogenous) country, and the lower suffix i indicates an industry based on the YNU-GIO classification. Conditions of both $\sum_p M(int)_i^{pq} = 1$ and $\sum_p M(f)_i^{pq} = 1$ hold.

Second, we aggregate 48 sector OECD IO tables into 35 sector IO tables, where domestic transactions and gross import blocks for intermediate goods are defined as Zd_{ij}^{pp} and Zm_{ij}^{wq}, respectively. The prior and posterior lower suffixes denote source and destination industries, respectively, for intermediate input transactions. Domestic and imported (gross) final demands are represented as Fd_i^{pp} and Fm_i^{wq}, respectively; value added inputs as V_j^p; gross export as E_i^p; and gross inputs/outputs as X_i^p. The domestic and disaggregated import blocks of intermediate and final goods transactions are calculated using the following equations:

For intermediate goods transactions,

$$Z_{ij}^{pq} = \begin{cases} Zd_{ij}^{pp} \text{ if } p = q \\ Zm_{ij}^{wq} * M(int)_i^{pq} \text{ if } p \neq q \end{cases},$$

and for final goods transactions,

$$F_i^{pq} = \begin{cases} Fd_i^{pp} \text{ if } p = q \\ Fm_i^{wq} * M(f)_i^{pq} \text{ if } p \neq q \end{cases}.$$

Thus, calculated domestic and import blocks along with the corresponding value added inputs and gross inputs are then reorganized into the GIO table. While country A's imports from country B is theoretically equivalent to country B's exports to country A, such export and import equality is not necessarily assured by the actual trade data. We adjust such inconsistency by the Statistical Discrepancy category of each endogenous

[1] Source country breakdown import share of intermediate goods is defined as the ratio of imports from the source country to the total imports of intermediate goods.

country, which completes the estimation of the benchmark YNU-GIO table.

The YNU-GIO tables for non-benchmark years from 1997 through 1999, from 2001 through 2004, and from 2006 through 2010 are estimated in a similar manner. The main difference lies in the estimation process of single country IO tables for the non-benchmark years. Specifically, we use the RAS method to estimate the non-benchmark single country IO tables.[2] We obtain the data on industry specific outputs and both intermediate input demand and supply from the UNIDO (United Nations Industrial Development Organization) Industry Statistics database (for manufacturing industries) and the UNSD (United Nations Statistics Division) National Accounts Main Aggregates Database (for other industries). These data are processed by the RAS method to estimate annual non-benchmark IO tables.

[2] See, for example, Miller and Blair (2009), pp. 313-20 for the details of the RAS Approach.

Table 1. US Import Decline from Selected Endogenous Countries

US Imports: Percentage Change over the Corresponding Period of the Previous Year

	World	Japan	China	Korea	Indonesia	Malaysia	Thailand	France	Germany	UK
2008Q1	11.5	3.6	1.7	-2.0	5.1	-3.8	6.6	10.8	8.8	10.5
2008Q2	13.9	2.6	6.1	2.3	11.1	7.7	5.7	10.8	12.9	4.1
2008Q3	14.4	-5.0	10.9	7.0	13.5	-4.0	8.1	4.1	1.9	12.0
2008Q4	-9.1	-16.7	-0.2	-2.5	10.2	-23.0	-5.7	-0.9	-9.7	-12.5
2009Q1	-29.7	-41.5	-11.5	-17.7	-11.3	-36.7	-24.0	-21.6	-29.9	-23.4
2009Q2	-34.3	-42.6	-16.6	-24.2	-20.3	-36.4	-29.7	-26.7	-40.3	-27.9
2009Q3	-28.9	-27.3	-18.5	-20.3	-26.4	-19.9	-20.5	-26.0	-26.9	-20.8
2009Q4	-7.0	-9.5	-4.3	-9.7	-13.1	2.0	-1.6	-16.0	-7.8	-1.3
2010Q1	20.8	28.2	12.9	3.5	16.0	22.3	15.7	9.7	4.9	10.4
2010Q2	31.6	36.0	28.3	30.3	33.1	25.5	29.5	12.2	30.0	9.0
2010Q3	23.6	24.2	32.0	34.3	35.0	5.2	21.9	17.3	21.7	1.6
2010Q4	16.3	19.0	21.2	32.0	28.8	-1.1	11.0	13.9	10.1	0.4

Note: Painted figures in pink indicate the negative percentage change of US imports over the corresponding period of the previous year..

Source: IMF, *Direction of Trade Statistics*, CD-ROM.

Table 2. Changes in US Imports of Finished Goods by Industry from 2008 to 2009

		World	Japan	China	Korea	Taiwan	Malaysia	Thailand	France	Germany	UK
2009	**Manufacturing Industries, Total**	**-137,449**	**-28,711**	**-17,684**	**-3,078**	**-2,094**	**-5,707**	**-1,803**	**-4,421**	**-12,041**	**-4,657**
Y03	Food, beverages and tobacco	-4,791	9	-611	5	-37	-75	23	-743	-54	-146
Y04	Textiles, leather and footwear	-15,883	-26	-3,568	-269	-485	-202	-637	-174	-51	-71
Y05	Wood product	-336	-1	-231	-1	-4	0	0	-1	-1	-1
Y06	Paper products, printing and publishing	-1,048	-84	-303	-31	0	-5	-8	-18	-49	-156
Y07	Coke, refined petroleum and nuclear fuel	42	-4	0	0	0	0	0	1	4	0
Y08	Chemicals and pharmaceuticals	1,466	367	-79	-2	-19	-5	-7	-1,254	895	-525
Y09	Rubber and plastics products	-1,957	-152	-668	-28	-140	-30	-6	-28	-75	-68
Y10	Other non-metallic mineral products	-645	-8	-324	16	-3	-6	-20	-38	-28	-24
Y11	Basic metals	0	0	0	0	0	0	0	0	0	0
Y12	Fabricated metal products	-1,200	124	-745	14	-154	-2	-33	27	-76	-13
Y13	Machinery and equipment, nec	-21,743	-5,823	-1,679	-205	-531	-98	-115	-710	-4,003	-1,049
Y14	Office, accounting and computing machinery	-5,724	-587	128	-148	-157	-4,076	-397	6	-93	-143
Y15	Electrical machinery and apparatus, nec	-4,773	-410	-720	28	-174	-12	-66	-56	-430	-124
Y16	Radio, television and communication equipment	-6,408	-1,753	100	-258	-236	-881	-176	-39	-104	-128
Y17	Medical, precision and optical instruments	-7,086	-1,265	-952	-211	321	-157	-84	-65	-1,000	-184
Y18	Motor vehicles	-50,001	-18,069	-274	-1,807	-44	1	-3	-152	-7,340	-1,869
Y19	Other transport equipment	-5,388	-864	-539	-115	-121	-18	1	-1,002	527	-71
Y20	Other Manufacturing	-11,975	-165	-7,218	-68	-308	-141	-276	-175	-164	-86

Note: Million US dollars. Painted figures in orange indicate the degree of changes is a minus number that is equal to -1,000 or larger in absolute terms. Painted figures in light orange denote the degree of changes is a minus number that is less than -1,000 in absolute terms. The industry classification is based on the YNU-GIO industry classfication code (Y03-Y20). See Appendix for details.

Source: Authors' calculation from the UN Comtrade.

Table 3. Simultaneous Shock Transmission Index (*SSTI*) in Intermediate Goods in 2009: Exports to the World (All Manufacturing)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
JPN	**131.3**	15.3	19.6	**28.4**	23.3	21.9	4.4	8.8	1.1	6.8	5.4	9.3	5.5	3.3	4.4	2.7	2.6	1.5	2.8	4.0	6.0	2.1	7.5	5.4	1.1	2.1	3.2
CHN	7.3	**154.0**	22.5	**25.6**	**29.4**	16.7	2.4	**29.8**	3.8	8.5	7.7	9.8	15.2	5.7	6.1	5.1	4.6	6.0	6.3	6.8	6.0	3.3	12.0	19.3	1.6	3.8	6.8
KOR	2.1	10.0	**134.6**	8.5	8.4	4.8	1.0	12.8	1.1	2.0	1.8	2.7	4.3	1.5	1.1	1.0	0.8	0.9	1.5	1.2	1.7	0.6	1.7	3.6	0.3	0.9	1.0
TWN	0.8	5.0	3.6	**71.7**	6.3	2.9	0.6	12.0	0.4	1.1	1.3	1.4	1.5	0.7	1.0	0.6	0.5	0.6	1.2	0.8	0.6	0.5	2.2	2.0	0.3	0.4	1.1
MAL	0.5	1.2	1.7	5.0	**52.8**	5.9	0.5	2.5	0.8	1.2	0.5	0.5	0.6	0.3	0.5	0.5	0.3	0.2	0.3	1.3	0.3	0.3	0.8	2.2	0.5	0.3	0.4
THL	0.7	1.1	0.8	1.5	4.9	**48.9**	1.6	4.6	0.3	2.2	0.4	0.4	0.6	0.4	0.4	0.2	0.2	0.2	0.3	0.5	0.5	0.2	0.6	1.8	0.1	0.3	0.6
IDN	0.8	0.6	0.9	0.7	2.1	1.4	22.9	1.3	0.7	0.7	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.5	0.3	0.1	0.2	0.2	0.5	0.3	0.2
VTM	0.5	0.3	0.4	0.5	0.6	0.8	0.1	**81.7**	0.1	0.3	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.4	0.1	0.0	0.1	0.1
IND	0.2	0.9	0.7	0.6	1.2	1.5	0.3	2.0	**126.2**	0.8	0.6	0.7	0.4	0.5	1.0	0.6	0.6	1.0	0.8	0.7	1.3	0.5	0.8	0.6	0.4	1.8	0.9
AUS	1.4	1.8	2.2	1.3	1.4	2.8	0.8	1.3	2.1	**108.0**	0.4	0.6	0.4	0.4	0.6	0.2	0.3	0.3	0.3	0.3	0.4	0.2	0.5	0.5	0.1	0.2	2.7
USA	2.7	5.6	7.9	8.5	21.9	6.7	1.2	4.7	1.9	8.8	**98.3**	**66.0**	24.7	7.9	7.7	4.5	6.2	3.6	4.1	7.0	7.8	3.7	5.6	**25.7**	3.4	2.7	7.0
CAN	0.3	0.7	0.8	0.5	0.7	0.4	0.2	0.4	0.3	0.7	4.6	**47.9**	1.6	0.6	0.8	0.3	0.6	0.3	0.4	0.5	0.7	0.4	0.5	1.0	0.4	0.3	0.7
MEX	0.1	0.3	0.3	0.2	0.4	0.2	0.0	0.1	0.1	1.1	3.2	5.2	17.6	0.5	0.3	0.2	0.2	0.2	0.4	0.2	0.3	0.2	0.3	0.5	0.1	0.2	0.3
BRA	0.4	1.3	0.8	0.6	0.6	1.1	0.2	1.0	0.4	0.5	0.8	1.2	1.1	**125.4**	0.6	0.7	0.8	1.0	1.1	1.6	1.0	0.5	0.8	0.6	0.3	1.5	1.4
UK	0.5	0.8	1.1	0.8	2.0	1.7	0.1	0.6	0.5	1.4	1.5	1.4	0.6	0.9	**81.0**	3.9	4.0	2.4	5.4	4.6	7.4	2.4	4.0	20.1	3.8	3.7	3.1
GER	1.3	5.6	4.5	3.6	9.2	2.8	0.4	1.6	1.2	3.9	3.0	3.5	4.0	3.2	11.8	**92.0**	14.8	9.9	19.7	17.5	**25.8**	**40.3**	20.8	7.7	17.0	17.6	8.1
FRA	0.5	1.4	1.4	0.8	2.0	1.0	0.2	0.8	0.4	1.5	1.3	1.2	0.7	1.6	6.2	5.6	**95.3**	5.6	16.5	5.6	15.0	4.0	4.0	5.9	7.8	9.5	3.5
ITA	0.3	1.1	1.0	0.8	1.2	1.0	0.1	1.3	0.4	1.2	0.9	1.1	0.8	1.1	3.7	4.6	6.9	**93.6**	7.4	2.9	5.9	7.0	3.4	2.9	2.4	8.7	1.5
SPN	0.2	0.4	0.3	0.7	0.4	0.3	0.0	0.2	0.1	0.5	0.3	0.3	0.5	0.8	2.2	2.2	4.6	2.2	**71.8**	1.7	4.3	1.7	1.5	2.0	1.0	22.2	1.2
NLD	0.2	0.5	0.5	0.5	0.8	0.5	0.1	0.3	0.2	0.5	0.4	0.4	0.3	0.3	3.5	3.0	3.0	2.4	3.1	**57.9**	11.2	2.5	2.6	11.5	4.9	3.0	0.7
BEL	0.2	0.7	0.4	0.5	0.6	0.6	0.1	0.3	0.4	0.5	0.4	0.4	0.3	0.5	2.8	2.6	4.7	2.3	3.0	5.6	**48.9**	1.7	1.7	2.1	8.7	2.7	0.6
AUT	0.1	0.3	0.3	0.3	0.7	0.2	0.0	0.1	0.1	0.3	0.3	0.3	0.2	0.3	0.8	3.4	1.0	1.7	1.4	1.1	1.6	**48.7**	1.3	0.6	0.8	1.2	0.5
FIN	0.1	0.3	0.2	0.2	0.2	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.6	0.5	0.4	0.4	0.5	1.0	0.6	0.5	**53.6**	0.5	0.5	0.4	0.1
IRE	0.1	0.1	0.1	0.2	1.6	0.1	0.0	0.1	0.0	0.2	0.2	0.2	0.1	0.1	1.3	0.6	0.8	0.7	0.7	0.6	1.5	0.3	0.6	**29.1**	0.6	0.4	0.1
LUX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.4	0.5	0.4	0.3	0.4	0.9	0.3	0.2	2.4	**25.8**	0.2	0.1
POR	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.4	0.4	0.7	0.3	3.0	0.3	0.6	0.3	0.3	0.5	0.2	**49.4**	0.1
SAF	1.0	0.6	0.5	0.6	0.4	0.5	0.1	0.2	0.9	0.5	0.4	0.3	0.2	0.3	0.8	0.7	0.4	0.7	0.5	0.4	0.9	0.4	0.3	0.4	0.3	0.3	**69.6**
HK	0.1	0.3	0.5	0.4	2.5	1.1	0.2	1.5	0.2	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.2	0.5	0.1	0.1	0.1
SIN	0.2	0.7	0.8	6.0	6.6	1.6	0.5	1.2	0.3	0.7	0.2	0.2	0.3	0.2	0.4	0.2	0.3	0.1	0.2	0.4	0.3	0.1	0.5	0.8	0.3	0.1	0.1
PHI	0.3	0.4	0.6	4.2	1.0	0.7	0.1	0.2	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.3	0.1	0.1	0.4	0.2	0.0	0.0	0.0
ROA	0.3	0.8	0.6	0.6	0.4	1.0	0.1	0.8	0.6	0.4	0.4	0.4	0.2	0.2	0.8	0.8	0.8	1.3	1.0	0.7	1.3	0.8	0.6	0.5	0.3	1.7	0.5
ROE	0.6	1.6	1.4	1.1	1.2	1.2	0.2	1.0	0.6	1.4	0.9	0.9	0.6	0.9	4.3	8.2	4.2	4.5	5.8	4.7	10.9	8.6	13.7	4.4	2.8	4.1	2.0
OPEC	1.8	2.7	3.0	5.1	1.5	2.0	0.4	2.5	3.1	0.8	0.7	0.8	0.5	2.2	0.7	0.6	1.0	1.7	1.8	0.9	1.1	0.5	0.4	0.6	0.6	1.1	1.6
ROW	0.8	2.0	2.2	1.6	3.4	2.3	0.3	1.5	1.9	2.6	1.5	2.3	1.1	3.4	2.9	4.5	3.7	4.5	4.1	5.1	3.8	4.8	3.7	7.0	3.9	3.3	1.8

Note: Painted figures indicate the following range of *SSTI*. SSTI < 1.0 | SSTI < 10.0 | SSTI < 25.0 | **SSTI ≥ 25.0**

Table 4. Simultaneous Shock Transmission Index (*SSTI*) in Value-Added in 2009: Exports to the World (All Manufacturing)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
JPN	**88.0**	6.3	7.9	11.5	9.4	8.2	1.6	4.1	0.4	2.6	2.1	3.5	2.1	1.3	1.7	1.1	1.0	0.6	1.1	1.6	2.3	0.8	3.0	2.2	0.5	0.8	1.2
CHN	2.0	**70.3**	6.1	7.1	7.6	4.4	0.7	9.6	1.1	2.4	2.1	2.7	3.8	1.6	1.7	1.4	1.3	1.7	1.8	1.9	1.7	0.9	3.4	4.7	0.5	1.1	1.9
KOR	0.6	2.7	**64.3**	2.5	2.5	1.3	0.3	4.2	0.3	0.5	0.5	0.7	1.1	0.5	0.3	0.3	0.2	0.2	0.4	0.4	0.5	0.2	0.5	0.9	0.1	0.2	0.3
TWN	0.2	1.3	1.0	**48.5**	1.7	0.8	0.2	3.4	0.1	0.3	0.4	0.4	0.4	0.2	0.3	0.2	0.1	0.2	0.3	0.2	0.2	0.1	0.6	0.6	0.1	0.1	0.3
MAL	0.2	0.4	0.5	1.3	**37.9**	1.4	0.2	0.9	0.3	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.2	0.5	0.2	0.1	0.1
THL	0.3	0.5	0.4	0.6	2.1	**63.4**	0.7	2.0	0.1	0.9	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.3	0.8	0.0	0.1	0.3
IDN	0.6	0.5	0.7	0.5	1.5	1.0	**93.0**	1.0	0.5	0.5	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.4	0.2	0.1	0.2	0.2	0.4	0.2	0.2
VTM	0.1	0.1	0.1	0.1	0.2	0.1	0.0	**54.6**	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
IND	0.1	0.4	0.3	0.2	0.4	0.4	0.1	0.9	**86.9**	0.3	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.4	0.3	0.3	0.4	0.2	0.3	0.2	0.2	0.7	0.3
AUS	0.6	0.9	0.9	0.5	0.6	1.1	0.3	0.6	0.8	**73.9**	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.9
USA	1.2	2.5	3.6	3.9	10.6	3.0	0.5	2.1	0.8	3.4	**82.8**	24.3	9.9	3.5	3.5	2.0	2.8	1.7	1.8	3.3	3.5	1.6	2.7	14.1	1.6	1.2	2.5
CAN	0.2	0.3	0.4	0.2	0.3	0.2	0.1	0.2	0.1	0.3	1.9	**52.8**	0.7	0.3	0.4	0.2	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.5	0.2	0.1	0.3
MEX	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.5	1.3	2.4	**34.3**	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.2
BRA	0.2	0.6	0.3	0.2	0.2	0.4	0.1	0.4	0.2	0.2	0.3	0.4	0.4	**80.8**	0.2	0.3	0.3	0.4	0.4	0.7	0.4	0.2	0.3	0.2	0.1	0.6	0.5
UK	0.2	0.3	0.5	0.4	0.9	0.7	0.0	0.2	0.2	0.5	0.6	0.6	0.2	0.4	**68.5**	1.5	1.6	1.1	2.1	2.1	2.9	1.0	1.8	9.3	1.8	1.5	1.0
GER	0.5	2.1	1.7	1.4	3.6	1.1	0.2	0.7	0.5	1.4	1.1	1.2	1.3	1.2	4.4	**69.3**	5.5	4.0	6.9	6.8	9.1	14.6	8.0	3.3	7.2	6.2	2.6
FRA	0.2	0.5	0.5	0.3	0.8	0.3	0.1	0.3	0.2	0.5	0.5	0.4	0.2	0.6	2.1	1.9	**67.6**	2.1	5.4	2.1	5.3	1.4	1.5	2.4	2.9	3.3	1.1
ITA	0.1	0.4	0.4	0.3	0.5	0.4	0.0	0.5	0.2	0.4	0.3	0.4	0.3	0.4	1.3	1.6	2.4	**70.4**	2.6	1.1	2.1	2.5	1.3	1.3	1.0	3.0	0.5
SPN	0.1	0.1	0.1	0.3	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.2	0.3	0.8	0.8	1.6	0.9	**58.3**	0.7	1.4	0.6	0.6	0.9	0.4	7.7	0.3
NLD	0.1	0.2	0.2	0.2	0.3	0.2	0.0	0.1	0.1	0.2	0.1	0.2	0.1	0.1	1.3	1.2	1.1	0.9	1.2	**61.6**	4.5	1.0	1.0	5.0	1.7	1.1	0.2
BEL	0.1	0.2	0.1	0.2	0.2	0.2	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.9	0.8	1.5	0.8	0.9	1.8	**44.4**	0.5	0.5	0.8	3.0	0.8	0.2
AUT	0.0	0.1	0.1	0.1	0.3	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	1.3	0.4	0.7	0.5	0.5	0.6	**58.2**	0.5	0.3	0.3	0.5	0.2
FIN	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.2	0.3	0.2	0.2	**51.8**	0.2	0.2	0.1	0.0
IRE	0.0	0.1	0.1	0.1	0.9	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.5	0.3	0.4	0.3	0.3	0.3	0.7	0.1	0.2	**35.1**	0.3	0.2	0.1
LUX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.1	0.4	0.1	0.1	1.3	**57.1**	0.1	0.0
POR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.1	1.0	0.1	0.2	0.1	0.1	0.2	0.1	**59.5**	0.0
SAF	0.3	0.2	0.2	0.2	0.2	0.2	0.0	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.2	0.2	0.1	0.3	0.1	0.1	0.2	0.1	0.1	**30.4**

Decline of Finished Goods Exports from 2008 to 2009 (Million US Dollars)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
Shock	112,882	78,908	21,732	20,472	9,489	10,687	2,303	1,591	2,200	4,761	106,674	22,099	18,799	16,759	34,985	134,092	46,003	53,897	19,140	24,912	30,946	15,384	14,647	6,025	639	3,861	4,454

Note: See Table 3. In the bottom of this table, "Shock" denotes the actual amount of decline in finished goods exports from 2008 to 2009.

Table 5: Simultaneous Shock Transmission Index (*SSTI*) in Intermediate Goods in 2009: Exports to the World (Electric Machinery)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA
JPN	**105.4**	**27.6**	**30.5**	**30.9**	**26.8**	17.8	1.8	0.0	2.2	1.0	4.8	8.0	3.0	8.4
CHN	16.9	**127.2**	**43.9**	**29.7**	**37.1**	**33.1**	3.0	0.0	6.9	2.5	10.4	17.8	8.7	**25.5**
KOR	3.4	17.6	**75.0**	9.5	10.0	5.3	1.2	0.0	2.0	0.5	2.1	3.3	3.0	10.3
TWN	1.7	6.9	8.8	**50.6**	7.2	4.0	0.6	0.0	0.8	0.3	1.6	2.9	0.8	3.6
MAL	1.0	2.0	3.6	6.4	**38.0**	14.7	0.7	0.0	1.0	0.3	1.5	2.3	0.4	1.6
THL	1.3	1.9	1.6	1.6	4.9	**32.2**	0.5	0.0	0.4	0.5	0.5	1.5	0.3	1.0
IDN	1.2	0.8	1.0	0.6	1.3	0.7	14.9	0.0	0.4	0.2	0.2	0.3	0.1	0.6
VTM	1.5	0.4	0.5	0.4	0.4	1.8	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.2
IND	0.3	0.9	0.6	0.6	0.8	0.5	0.4	0.0	**120.7**	0.3	0.5	0.5	0.1	0.5
AUS	1.4	1.7	1.4	1.3	0.9	1.1	0.4	0.0	4.4	18.7	0.3	0.4	0.2	0.6
USA	3.9	7.7	10.8	7.5	**26.8**	11.4	1.1	0.0	2.8	1.4	**80.1**	**29.1**	7.7	6.3
CAN	0.4	0.7	0.8	0.5	0.6	0.3	0.2	0.0	0.3	0.1	2.8	21.5	0.5	0.5
MEX	0.2	0.5	0.4	0.2	0.5	0.3	0.0	0.0	0.1	0.1	2.1	2.0	4.4	0.9
BRA	0.5	1.0	0.6	0.5	0.3	0.3	0.1	0.0	0.3	0.1	0.4	0.5	0.3	**99.2**
Shock	9,932	20,787	6,354	4,228	5,817	2,700	3	74	419	206	6,682	1,100	7,171	1,034

	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
UK	**60.8**	3.4	4.0	2.6	4.6	7.5	5.1	2.4	4.5	18.4	1.0	4.4	1.7
GER	10.5	**91.5**	12.0	11.2	16.4	17.1	16.8	**27.6**	18.1	8.7	4.0	23.8	6.7
FRA	4.6	4.0	**98.2**	5.7	10.0	6.5	10.6	2.9	4.0	6.7	1.6	8.4	1.7
ITA	2.4	2.7	5.4	**82.3**	6.6	2.7	3.6	4.8	2.2	3.0	0.5	7.1	1.1
SPN	1.6	1.6	3.2	2.4	**53.0**	2.3	2.6	1.3	1.4	2.1	0.2	**31.8**	0.6
NLD	4.4	3.5	3.3	2.7	3.6	**63.5**	11.5	2.6	2.6	15.2	1.4	5.1	0.8
BEL	2.3	2.2	3.9	2.2	2.7	6.0	**65.0**	1.5	1.5	2.1	2.0	3.5	1.6
AUT	0.7	2.4	0.9	1.5	1.0	1.4	1.2	**63.4**	1.1	0.7	0.2	1.2	0.6
FIN	0.4	0.5	0.4	0.4	0.5	1.2	0.6	0.4	**51.4**	0.4	0.1	0.6	0.2
IRE	1.2	0.6	1.0	0.8	0.7	1.4	1.2	0.4	0.8	12.4	0.2	0.6	0.3
LUX	0.2	0.3	0.4	0.4	0.3	0.6	1.1	0.2	0.1	2.8	4.6	0.3	0.1
POR	0.4	0.5	0.6	0.3	3.5	0.4	0.9	0.3	0.4	0.6	0.0	**46.9**	0.1
SAF	0.6	0.4	0.7	0.7	0.4	0.5	0.7	0.3	0.3	0.4	0.1	0.4	**93.2**
Shock	3,636	11,203	3,272	1,911	2,105	4,034	1,929	1,198	6,807	3,530	92	268	72

Note: See footnotes of Tables 3 and 4. In the bottom of this table, "Shock" denotes the actual amount of decline in finished goods exports from 2008 to 2009 (million US dollars).

Table 6. Simultaneous Shock Transmission Index (*SSTI*) in Value-Added in 2009: Exports to the World (Electric Machinery)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA
JPN	**81.5**	11.1	12.6	12.3	10.7	6.9	0.8	0.0	0.9	0.4	1.9	3.1	1.2	3.4
CHN	4.5	**56.6**	11.7	8.2	9.3	8.0	0.9	0.0	1.9	0.7	2.7	4.4	2.2	7.1
KOR	0.9	4.7	**48.5**	2.8	2.9	1.5	0.3	0.0	0.5	0.1	0.5	0.8	0.8	3.2
TWN	0.5	2.0	2.4	**44.8**	2.0	1.2	0.1	0.0	0.2	0.1	0.5	0.9	0.2	1.0
MAL	0.3	0.5	0.9	1.6	**29.6**	3.1	0.2	0.0	0.3	0.1	0.3	0.5	0.1	0.4
THL	0.5	0.8	0.7	0.7	2.1	**57.6**	0.2	0.0	0.2	0.2	0.2	0.7	0.1	0.4
IDN	0.9	0.6	0.7	0.5	0.8	0.4	**93.3**	0.0	0.3	0.1	0.1	0.2	0.1	0.4
VTM	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IND	0.1	0.4	0.2	0.2	0.3	0.2	0.2	0.0	**79.0**	0.1	0.2	0.2	0.1	0.2
AUS	0.6	0.8	0.6	0.5	0.4	0.4	0.1	0.0	1.6	15.3	0.1	0.2	0.1	0.3
USA	1.7	3.5	5.2	3.5	13.1	5.4	0.5	0.0	1.2	0.6	**84.2**	13.6	3.3	2.9
CAN	0.2	0.4	0.4	0.2	0.3	0.2	0.1	0.0	0.2	0.1	1.3	**65.3**	0.2	0.2
MEX	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.7	0.8	10.3	0.2
BRA	0.2	0.4	0.3	0.2	0.1	0.1	0.0	0.0	0.1	0.0	0.2	0.2	0.1	**67.3**
Shock	9,932	20,787	6,354	4,228	5,817	2,700	3	74	419	206	6,682	1,100	7,171	1,034

	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
UK	**66.8**	1.5	1.7	1.2	2.1	3.9	2.3	1.1	2.3	8.7	0.5	1.9	0.7
GER	3.9	**65.3**	4.6	4.4	6.5	7.2	6.7	11.0	7.8	3.7	1.7	9.1	2.5
FRA	1.7	1.5	**67.2**	2.2	3.8	2.7	4.3	1.1	1.6	2.7	0.6	3.1	0.6
ITA	0.9	1.0	1.9	**69.0**	2.4	1.2	1.4	1.8	0.9	1.3	0.2	2.5	0.4
SPN	0.6	0.6	1.2	0.9	**50.2**	1.1	1.0	0.5	0.7	1.0	0.1	11.0	0.2
NLD	1.5	1.3	1.2	1.0	1.3	**43.7**	4.4	0.9	1.0	6.5	0.4	1.8	0.3
BEL	0.7	0.7	1.3	0.8	0.9	2.3	**53.9**	0.5	0.6	0.8	0.7	1.1	0.6
AUT	0.3	1.0	0.3	0.6	0.4	0.6	0.5	**59.4**	0.5	0.3	0.1	0.5	0.2
FIN	0.1	0.2	0.1	0.2	0.2	0.4	0.2	0.1	**43.1**	0.2	0.0	0.2	0.1
IRE	0.5	0.2	0.4	0.4	0.3	0.6	0.5	0.2	0.3	20.4	0.1	0.3	0.1
LUX	0.1	0.1	0.1	0.2	0.1	0.2	0.4	0.1	0.0	1.6	10.6	0.1	0.0
POR	0.1	0.2	0.2	0.1	1.2	0.2	0.3	0.1	0.2	0.3	0.0	**46.8**	0.1
SAF	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.0	0.2	**55.6**
Shock	3,636	11,203	3,272	1,911	2,105	4,034	1,929	1,198	6,807	3,530	92	268	72

Note: See footnote of Tables 5.

Table 7. Simultaneous Shock Transmission Index (*SSTI*) in Intermediate Goods in 2009: Exports to the World (Transport Equipment)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA
JPN	**148.7**	12.9	15.8	**37.9**	**30.9**	**35.4**	13.7	17.2	0.0	13.1	6.3	13.8	7.5	4.7
CHN	5.2	**183.0**	13.8	17.7	19.2	10.8	3.8	**40.7**	0.0	12.2	8.0	12.1	17.8	5.4
KOR	1.7	7.3	**169.2**	5.9	7.0	5.2	1.4	9.1	0.0	3.0	2.0	3.6	5.2	1.2
TWN	0.6	3.6	1.4	**90.3**	4.3	2.3	0.7	9.8	0.0	1.8	1.4	1.7	1.8	0.6
MAL	0.4	0.8	0.9	2.2	**75.0**	3.1	1.2	5.2	0.0	1.0	0.5	0.5	0.7	0.2
THL	0.6	0.7	0.5	2.0	14.8	**46.8**	4.8	14.2	0.0	3.5	0.4	0.4	0.7	0.6
IDN	0.7	0.5	0.8	1.1	5.2	2.2	13.2	3.0	0.0	0.7	0.2	0.2	0.2	0.2
VTM	0.3	0.2	0.3	0.4	0.8	0.6	0.1	**73.2**	0.0	0.3	0.1	0.1	0.1	0.0
IND	0.2	0.9	0.7	0.5	1.9	1.5	0.4	1.7	0.0	1.0	0.7	0.8	0.5	0.6
AUS	1.1	2.3	2.4	1.4	2.8	3.6	1.1	2.9	0.0	**102.5**	0.4	0.7	0.5	0.5
USA	2.0	5.7	6.5	5.8	11.3	5.0	2.0	15.2	0.0	14.4	**101.5**	**92.4**	**33.7**	12.3
CAN	0.3	0.7	0.8	0.4	0.6	0.4	0.2	0.8	0.0	1.1	5.0	**46.8**	2.4	0.9
MEX	0.1	0.3	0.2	0.2	0.3	0.2	0.1	0.4	0.0	2.3	3.7	7.8	23.0	0.6
BRA	0.3	1.4	0.9	0.5	0.7	0.8	0.2	0.8	0.0	0.7	0.8	1.2	1.7	**124.5**
Shock	61,031	11,865	9,609	140	226	3,572	660	131	0	1,971	71,384	12,894	7,591	7,185

	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
UK	**96.4**	5.4	5.3	3.1	7.3	4.8	10.5	3.5	4.6	0.0	0.8	5.4	5.4
GER	17.0	**108.1**	21.8	15.0	**31.7**	**27.3**	**41.8**	**71.6**	**38.9**	0.0	3.4	**33.5**	14.2
FRA	9.0	7.5	**97.7**	7.4	**27.0**	6.5	17.0	6.3	5.8	0.0	2.2	17.2	6.1
ITA	5.1	5.9	8.7	**99.6**	10.3	3.8	7.4	9.4	6.3	0.0	0.5	8.7	2.7
SPN	3.3	3.2	6.9	2.9	**70.7**	2.4	7.1	2.8	2.0	0.0	0.2	**32.1**	2.1
NLD	3.8	3.1	2.9	2.6	3.5	**47.9**	9.6	3.1	3.2	0.0	1.4	3.3	1.2
BEL	3.5	3.0	4.7	2.5	3.8	8.0	**26.6**	2.2	2.0	0.0	2.3	3.6	1.0
AUT	1.1	4.9	1.3	2.0	2.3	1.9	2.3	**30.2**	2.4	0.0	0.1	1.5	0.9
FIN	0.5	0.5	0.4	0.6	0.6	1.0	0.5	0.5	**35.5**	0.0	0.4	0.5	0.2
IRE	1.4	0.6	0.7	0.7	0.7	0.4	0.6	0.3	0.3	0.0	0.1	0.4	0.2
LUX	0.3	0.5	0.5	0.4	0.3	0.4	0.6	0.4	0.2	0.0	5.2	0.3	0.1
POR	0.5	0.5	1.0	0.4	3.8	0.3	0.7	0.4	0.3	0.0	0.1	**34.7**	0.2
SAF	1.0	0.9	0.5	0.8	0.7	0.4	1.1	0.6	0.4	0.0	0.0	0.4	**117.0**
Shock	13,209	59,557	17,263	8,985	8,793	5,620	11,656	4,466	2,802	0	140	1,311	2,492

Note: See footnote of Tables 5.

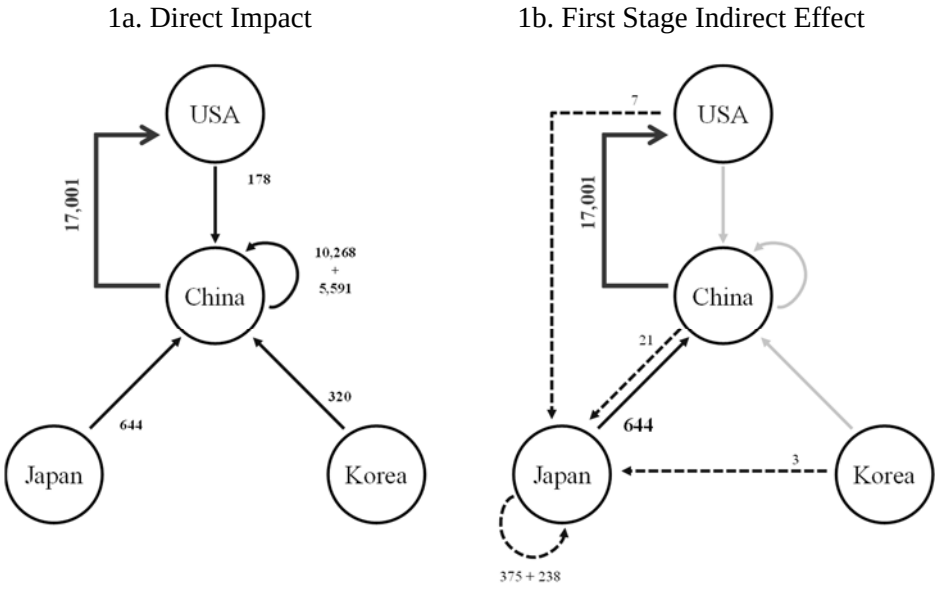
Table 8. Simultaneous Shock Transmission Index (*SSTI*) in Value-Added in 2009: Exports to the World (Transport Equipment)

	JPN	CHN	KOR	TWN	MAL	THL	IDN	VTM	IND	AUS	USA	CAN	MEX	BRA
JPN	**90.5**	5.1	6.2	14.3	11.6	13.0	5.0	7.1	0.0	4.9	2.4	5.1	2.9	1.8
CHN	1.4	**72.5**	3.9	4.8	5.3	3.0	1.0	12.5	0.0	3.3	2.2	3.2	4.5	1.6
KOR	0.4	1.9	**71.0**	1.6	1.9	1.3	0.4	3.1	0.0	0.8	0.5	1.0	1.4	0.4
TWN	0.2	0.9	0.4	**57.2**	1.2	0.6	0.2	3.3	0.0	0.5	0.4	0.5	0.5	0.2
MAL	0.2	0.3	0.4	0.6	**42.1**	0.9	0.3	1.8	0.0	0.4	0.1	0.1	0.2	0.1
THL	0.3	0.3	0.2	0.8	6.3	**61.5**	2.0	5.8	0.0	1.4	0.2	0.2	0.3	0.2
IDN	0.5	0.4	0.6	0.8	3.8	1.6	**86.0**	2.5	0.0	0.5	0.1	0.2	0.1	0.2
VTM	0.1	0.1	0.1	0.1	0.3	0.1	0.0	**34.2**	0.0	0.2	0.0	0.0	0.0	0.0
IND	0.1	0.4	0.3	0.2	0.7	0.5	0.2	0.8	0.0	0.3	0.3	0.3	0.2	0.2
AUS	0.5	1.1	1.0	0.6	1.1	1.4	0.4	1.2	0.0	**67.0**	0.2	0.3	0.2	0.2
USA	0.9	2.5	2.9	2.5	5.2	2.1	0.8	6.9	0.0	5.3	**81.5**	**32.8**	13.0	5.4
CAN	0.1	0.3	0.3	0.2	0.3	0.2	0.1	0.4	0.0	0.4	2.0	**43.1**	0.9	0.4
MEX	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.0	1.1	1.5	3.7	**52.8**	0.3
BRA	0.1	0.6	0.4	0.2	0.3	0.3	0.1	0.4	0.0	0.3	0.3	0.5	0.6	**76.2**
Shock	61,031	11,865	9,609	140	226	3,572	660	131	0	1,971	71,384	12,894	7,591	7,185

	UK	GER	FRA	ITA	SPN	NLD	BEL	AUT	FIN	IRE	LUX	POR	SAF
UK	**61.4**	2.0	2.0	1.3	2.7	1.8	3.6	1.3	1.6	0.0	0.4	1.9	1.8
GER	6.1	**63.6**	7.7	5.7	10.6	9.1	13.5	22.9	12.5	0.0	1.5	11.0	4.5
FRA	3.0	2.5	**60.2**	2.7	8.5	2.2	5.5	2.1	1.9	0.0	0.9	5.5	1.9
ITA	1.8	2.0	3.0	**64.9**	3.5	1.3	2.5	3.2	2.1	0.0	0.2	2.9	0.9
SPN	1.1	1.1	2.2	1.0	**45.8**	0.8	2.1	0.9	0.6	0.0	0.1	9.9	0.6
NLD	1.5	1.2	1.1	1.1	1.4	**60.4**	4.0	1.2	1.3	0.0	0.5	1.3	0.4
BEL	1.0	0.9	1.4	0.8	1.1	2.1	**30.1**	0.6	0.6	0.0	0.8	1.0	0.3
AUT	0.4	1.7	0.5	0.8	0.8	0.7	0.8	**43.4**	0.8	0.0	0.1	0.6	0.3
FIN	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.2	**50.2**	0.0	0.1	0.2	0.1
IRE	0.5	0.2	0.3	0.3	0.3	0.2	0.3	0.1	0.1	0.0	0.1	0.2	0.1
LUX	0.1	0.2	0.2	0.2	0.1	0.2	0.3	0.2	0.1	0.0	**92.2**	0.1	0.0
POR	0.2	0.2	0.3	0.1	1.3	0.1	0.2	0.1	0.1	0.0	0.0	**45.7**	0.1
SAF	0.3	0.3	0.2	0.3	0.2	0.1	0.3	0.2	0.1	0.0	0.0	0.1	**49.8**
Shock	13,209	59,557	17,263	8,985	8,793	5,620	11,656	4,466	2,802	0	140	1,311	2,492

Note: See footnote of Tables 5.

Figure 1. Graphic Illustration of Shock Transmission: Case of 4 Endogenous Counties

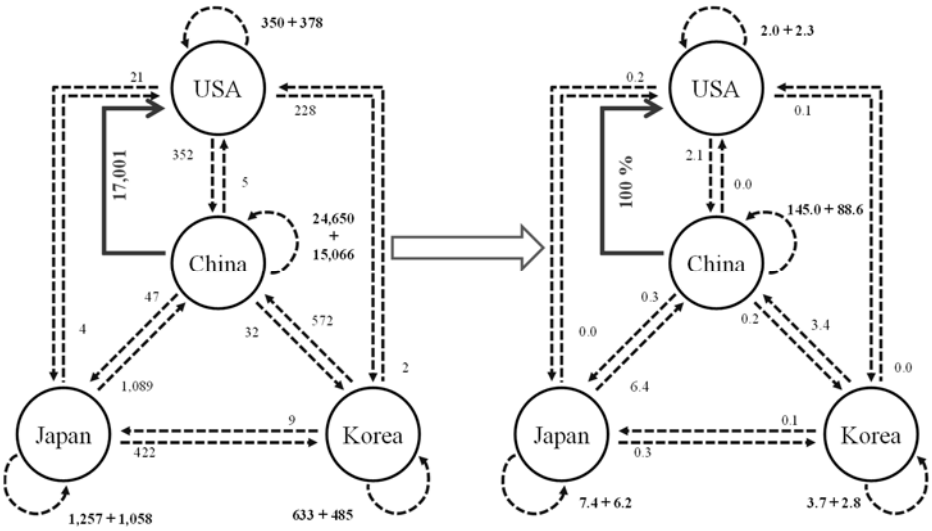


Note: Figures are in terms of million US dollars. It is assumed that Chinese exports of finished goods decline (10% decline in actual finished goods export in 2005) by US$17 billion (a thick arrow). (1a) The direct effect causes not only a fall of China's production but also induces a fall in intermediate input imports from other three countries (thin arrows). (1b) A fall in China's imports of intermediate inputs from Japan causes not only a decline in Japanese production but also a fall of Japanese imports from other three countries (dotted arrows).

Source: YNU-GIO table and UN Comtrade database.

Figure 2. Final Stage Direct and Indirect Effect and Shock Transmission Index (*STI*)

2a. Final Stage Direct and Indirect Effect 2b. Conversion to *STI*



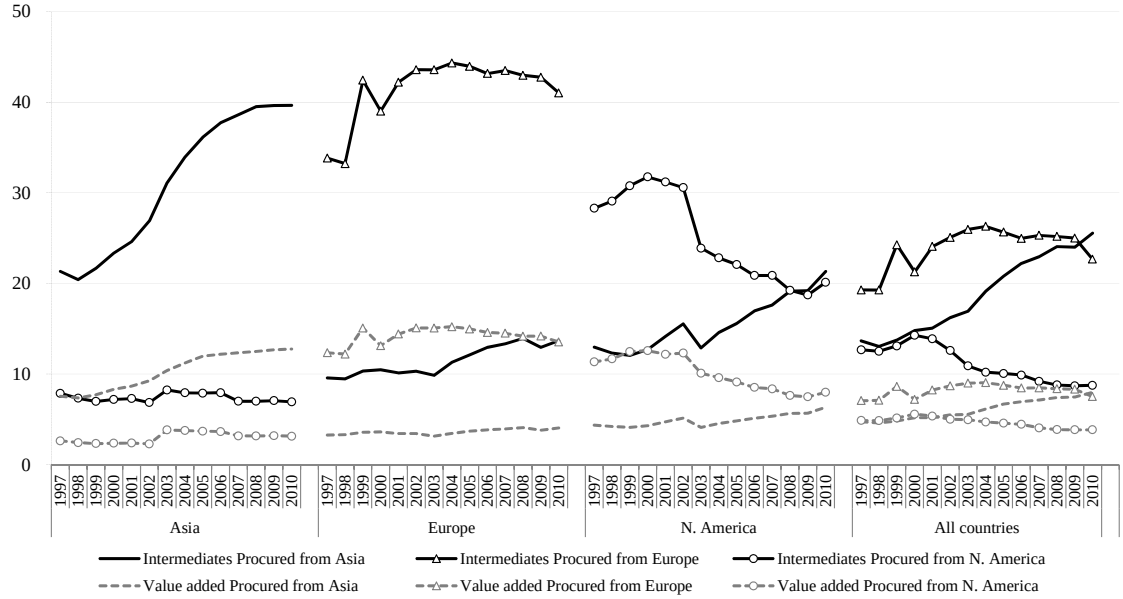
Note: (2a) The sum of direct and cumulative indirect effects is presented (million US dollars).

(2b) Cumulative indirect effects are standardized by the direct impact (100%) and *STI* (percentage term) is reported.

Source: YNU-GIO table and UN Comtrade database.

Figure 3. Regional Value Chains of Intermediate Inputs and Value-Added Contents

(Manufacturing Industry, 1997-2010, Percent of Finished Goods Exports)



Source: Authors' calculation.